it nestles in the heath-clad mountains of at least the more northern parts of the island*, and from its occurrence to me in such localities in mid-winter, I am disposed to believe that severity of weather only drives it from such haunts. It is distinguished in the north of Ireland from the other linnets (*Linariæ*) by the name of "*Heather*-grey." A friend frequently before alluded to, remarks that he has seen these birds every winter for some years past in large flocks about Clough, in the county of Antrim, where they chiefly frequent the stubble-fields in the neighbourhood of the mountains. A person conversant with this species states, that he has frequently had its nests among heath on the top of the Knockagh, a mountain near Carrickfergus: in this plant they were generally placed, but in some instances were built in dwarfed whins which grew amid the heath. A venerable sporting friend has always met with these birds about their nests (which he remarks were placed in "tufts of heather") when breaking his dogs on the Belfast mountains preparatory to grouse-shooting. From the county of Fermanagh I have had specimens of this bird. Mr. R. Ball includes it among the species found in the neighbourhood of Dublin.

[To be continued.]

XLVII.—*Extracts from a Lecture by* M. Dumas *on the Chemical Statics of Organized Beings* †.

If, in the dark, plants act as simple filters which water and gases pass through; if, under the influence of solar light they act as reducing apparatus which decompose water, carbonic acid and oxide of ammonium, there are certain epochs and certain organs in which the plant assumes another, and altogether opposite part.

Thus, if an embryo is to be made to germinate, a bud to be unfolded, a flower to be fecundated, the plant which absorbed the solar heat, which decomposed carbonic acid and water, all at once changes its course. It burns carbon and hydrogen; it produces heat, that is to say, it takes to itself the principal characters of animal life.

But here a remarkable circumstance reveals itself. If barley or wheat is made to germinate, much heat, carbonic acid and water are produced. The starch of these grains first changes into gum, then into sugar, then it disappears in producing carbonic acid, which the germ is to assimilate. Does a potato

* Since the above was written, Mr. R. Davis, jun., of Clonmel, has informed me that it is common and breeds in the county of Tipperary.

† The lecture from which these are extracts has appeared in the Philosophical Magazine for November and December 1841.

germinate, here also it is its starch which changes into dextrine, then into sugar, and which at last produces carbonic acid and heat. Sugar, therefore, seems the agent by means of which plants develop heat as they need it.

How is it possible not to be struck from this with the coincidence of the following facts?—Fecundation is always accompanied by heat; flowers as they breathe produce carbonic acid. They therefore consume carbon; and if we ask whence this carbon comes, we see in the sugar cane, for example, that the sugar accumulated in the stalk has entirely disappeared when the flowering and fructification are accomplished. In the beet root, the sugar continues increasing in the roots until it flowers; the seed-bearing beet contains no trace of sugar in its root. In the parsnep, the turnip and the carrot, the same phænomena take place.

Thus at certain epochs, in certain organs, the plant turns into an animal; it becomes like it an apparatus of combustion; it burns carbon and hydrogen; it gives out heat.

But at these same periods, it destroys in abundance the saccharine matters which it had slowly accumulated and stored up. Sugar, or starch turned into sugar, are then the primary substances by means of which plants develop heat as required for the accomplishment of some of their functions.

And if we remark with what instinct animals, and men too, choose for their food just that part of the vegetable in which it has accumulated the sugar and starch which serve it to develop heat, is it not probable, that, in the animal œconomy, sugar and starch are also destined to act the same part, that is to say, to be burned for the purpose of developing the heat which accompanies the phænomenon of respiration?

To sum up, as long as the vegetable preserves its most habitual character, it draws from the sun heat, light, and chemical rays. From the air it receives carbon, from water it takes hydrogen, azote from the oxide of ammonium, and different salts from the earth. With these mineral or elementary substances, it composes the organized substances which accumulate in its tissues.

They are ternary substances, ligneous matter, starch, gums and sugars.

They are quaternary substances, fibrin, albumen, caseum, and gluten.

So far then the vegetable is an unceasing producer; but if at times, if to satisfy certain wants, the vegetable becomes a consumer, it realizes exactly the same phænomena which the animal will now set before us.

An animal in fact constitutes an apparatus of combustion from which carbonic acid is continually disengaged, in which consequently carbon undergoes combustion.

You know that we were not stopped by the expression *cold-blooded animals*, which would seem to designate some animals destitute of the property of producing heat. Iron, which burns vividly in oxygen, produces a heat which no one would deny; but reflection and some science is necessary in order to perceive, that iron which rusts slowly in the air disengages quite as much, although its temperature does not sensibly vary. No one doubts that lighted phosphorus in burning produces a great quantity of heat. Unkindled phosphorus also burns in the air, and yet the heat which it develops in this state was for a long time disputed.

So as to animals, those which are called warm-blooded burn much carbon in a given time, and preserve a sensible excess of heat above the surrounding bodies; those which are termed cold-blooded burn much less carbon, and consequently retain so slight an excess of heat, that it becomes difficult or impossible to observe it.

But nevertheless, reflection shows us that the most constant character of animal existence resides in this combustion of carbon, and in the development of carbonic acid which is the result of it, beginning also in the production of heat which every combustion of carbon occasions.

Whether the question be of superior or inferior animals; whether this carbonic acid be exhaled from the lungs or from the skin, does not signify; it is always the same phænomenon, the same function.

At the same time that animals burn carbon, they also burn hydrogen; this is a point proved by the constant disappearance of hydrogen which takes place in their respiration.

Besides, they continually exhale azote. I insist upon this point, and principally in order to banish an illusion which I cannot but believe to be one of the most prejudicial to your studies. Some observers have admitted that there is an absorption of azote in respiration, but which never appears unaccompanied by circumstances that render it more than doubtful. The constant phænomenon is the exhalation of gas.

We must therefore conclude with certainty, that we never borrow azote from the air; that the air is never an aliment to us; and that we merely take from it the oxygen necessary to form carbonic acid with our carbon, and water with our hydrogen.

The azote exhaled proceeds then from the aliments, and it originates from them entirely. This, in the general œconomy of nature, may in thousands of centuries be absorbed by plants, which, like Jerusalem artichokes, draw their azote directly from the air.

But this is not all the azote which animals exhale. Every one gives out by the urine, on an average, as M. Lecanu has proved, 230 grains of azote a day, of azote evidently drawn from our food, like the carbon and hydrogen which are oxidized within us (*que nous brûlons*).

In what form does this azote escape? In the form of ammonia. Here indeed, one of those observations presents itself which never fail to fill us with admiration for the simplicity of the means which nature puts in operation.

If in the general order of things we return to the air the azote which certain vegetables may sometimes directly make use of, it ought to happen that we should also be bound to return ammonia, a product so necessary to the existence and development of most vegetables.

Such is the principal result of the urinary secretion. It is an emission of ammonia, which returns to the soil or to the air.

But is there any need to remark here, that the urinary organs would be changed in their functions and in their vitality by the contact of ammonia? the contact of the carbonate of ammonia would even effect this; and so nature causes us to excrete urea.

Urea is carbonate of ammonia, that is to say, carbonic acid like that which we expire, and ammonia such as plants require. But this carbonate of ammonia has lost of hydrogen and oxygen, so much as is wanting to constitute two molecules of water.

Deprived of this water the carbonate of ammonia becomes urea; then it is neutral, not acting upon the animal membranes; then it may pass through the kidneys, the ureters, and the bladder, without inflaming them; but having reached the air, it undergoes a true fermentation, which restores to it these two molecules of water, and which makes of this same urea true carbonate of ammonia; volatile, capable of exhaling in the air; soluble, so that it may be taken up again by rain; and consequently destined thus to travel from the earth to the air and from the air to the earth, until, pumped up by the roots of a plant and elaborated by it, it is converted anew into an organic matter.

Let us add another feature to this picture. In the urine, along with urea, nature has placed some traces of albuminous or mucous animal matter, traces which are barely sensible to analysis. This, however, when it has reached the air, is there modified, and becomes one of those ferments of which we find so many in organic nature; it is this which determines the conversion of urea into carbonate of ammonia.

These ferments, which have so powerfully attracted our attention, and which preside over the most remarkable metamorphoses of organic chemistry, I reserve for the next year, when I shall give you a still more particular and full account of them.

Thus we discharge urea accompanied by this ferment, by this artifice, which acting at a given moment, turns this urea into carbonate of ammonia.

If we restore to the general phænomenon of animal combustion that carbonic acid of the carbonate of ammonia which of right belongs to it, there remains ammonia as the characteristic product of urine.

Thus, By the lungs and the skin, carbonic acid, water, azote;
By the urine, ammonia.

Such are the constant and necessary products which exhale from the animal.

These are precisely those which vegetation demands and makes use of, just as the vegetable in its turn gives back to the air the oxygen which the animal has consumed.

Whence come this carbon, this hydrogen burnt by the animal, this azote which it has exhaled in a free state or converted into ammonia? They evidently come from the aliments.

By studying digestion in this point of view, we have been led to consider it in a manner much more simple than is customary, and which may be summed up in a few words.

In fact, as soon as it was proved to us that the animal creates no organic matter; that it merely assimilates or expends it by burning it (*en la brûlant*), there was no occasion to seek in digestion all those mysteries which we were quite sure of not finding there.

Thus digestion is indeed but a simple function of absorption. The soluble matters pass into the blood, for the most part unchanged; the insoluble matters reach the chyle, sufficiently divided to be taken up by the orifices of the chyliferous vessels.

Besides, the evident object of digestion is to restore to the blood a matter proper for supplying our respiration with the ten or fifteen grains of coal, or the equivalent of hydrogen which each of us burns every hour, and to restore to it the grain of azote which is also hourly exhaled, as well by the lungs or the skin as by the urine.

Thus the amylaceous matters are changed into gum and sugar; the saccharine matters are absorbed.

The fatty matters are divided, and converted into an emulsion, and thus pass into the vessels, in order to form depôts which the blood takes back and burns as it needs.

The neutral azotated substances, fibrin, albumen and caseum, which are at first dissolved, and then precipitated, pass into the chyle greatly divided or dissolved anew.

The animal thus receives and assimilates almost unaltered the azotated neutral substances which it finds ready formed in the animals or plants upon which it feeds; it receives fatty matters which come from the same sources; it receives amylaceous or saccharine matters which are in the same predicament.

These three great orders of matters, whose origin always ascends to the plant, become divided into products capable of being assimilated, fibrin, albumen, caseum, fatty bodies, which serve to renew or recruit the organs with the combustible products, sugar and fatty bodies which respiration consumes.

The animal therefore assimilates or destroys organic matters ready formed; it does not create them.

Digestion introduces into the blood organic matters ready formed; assimilation employs those which are azotated; respiration burns the others.

If animals do not possess any peculiar power for producing organic matters, have they at least that special and singular power which has been attributed to them of producing heat without expenditure of matter?

You have seen, while discussing the experiments of MM. Dulong and Despretz, you have positively seen the contrary result from them. These skilful physicists supposed that an animal placed in a cold water calorimeter comes out of it with the same temperature that it had on entering it; a thing absolutely impossible, as is now well known. It is this cooling of the animal, of which they took no account, that expresses in their *tableaux* the excess of heat attributed by them and by all physiologists to a calorific power peculiar to the animal and independent of respiration.

It is evident to me that all animal heat arises from respiration; that it is measured by the carbon and hydrogen burnt. In a word, it is evident to me that the poetical comparison of a rail-road locomotive to an animal is founded on a more serious basis than has perhaps been supposed. In each there are combustion, heat, motion, three phænomena connected and proportional.

You see, that thus considering it, the animal machine becomes much easier to understand; it is the intermediary between the vegetable kingdom and the air; it borrows all its aliments from the one, in order to give all its excretions to the other.

Shall I remind you how we viewed respiration, a phænomenon more complex than Laplace and Lavoisier had thought, or even Lagrange* had supposed, but which precisely, as it becomes complicated, tends more and more to enter into the general laws of inanimate nature?

You have seen that the venous blood dissolves oxygen and disengages carbonic acid; that it becomes arterial without producing a trace of heat. It is not then in becoming arterial that the blood produces heat.

But under the influence of the oxygen absorbed, the soluble matters of the blood change into lactic acid, as MM. Mitscherlich, Boutron-Charlard and Fremy observed; the lactic acid is itself converted into lactate of soda; this latter by a real combustion into carbonate of soda, which a fresh portion of lactic acid decomposes in its turn. This slow and continued succession of phænomena which constitutes a real combustion, but decomposed at several times, in which we see one of the slow combustions to which M. Chevreul drew attention long ago, this is the true phænomenon of respiration. The blood then becomes oxygenized in the lungs; it really breathes in the capillaries of all the other organs, there where the combustion of carbon and the production of heat principally take place.

To sum up, then, we see that of the primitive atmosphere of the earth three great parts have been formed:

One which constitutes the actual atmospheric air; the second, which is represented by vegetables, the third by animals.

Between these three masses, continual exchanges take place: matter descends from the air into plants, enters by this route into animals, and returns to the air according as these make use of it.

Green vegetables constitute the great laboratory of organic chemistry. It is they which, with carbon, hydrogen, azote, water and oxide of ammonium, slowly build up all the most complex organic matters.

They receive from the solar rays, under the form of heat or of chemical rays, the powers necessary for this work.

Animals assimilate or absorb the organic matters formed by plants. They change them by little and little, they destroy them. In their organs, new organic substances may come into existence, but they are always substances more sim-

* The reader will no doubt admire how entirely M. Dumas passes by all English philosophers,—even him with whom these trains of investigation originated. "This beautiful discovery [of the chemical action of light, heat, and the component parts of atmospheric air upon plants], for the main principles of which we are indebted to Dr. Priestley, shows a mutual dependence of the animal and vegetable kingdoms on each other which had never been suspected before his time."—Sir J. E. Smith's Introduction to Botany, see p. 162—170.

ple, more akin to the elementary state than those which they have received. By degrees these decompose the organic matters slowly created by plants; they bring them back little by little towards the state of carbonic acid, water, azote and ammonia, a state which allows them to be returned to the air.

In burning or destroying these organic matters, animals always produce heat, which radiating from their bodies in space, goes to supply the place of that which vegetables had absorbed.

Thus all that air gives to plants, plants give up to animals, and animals restore it to the air,—an eternal circle in which life keeps in motion and manifests itself, but in which matter merely changes place.

The brute matter of air, organized by slow degrees in plants, comes, then, to perform its part without change in animals, and serves as an instrument for thought; then vanquished by this effort and broken, as it were, it returns brute matter to the great reservoir whence it came.

BIBLIOGRAPHICAL NOTICES.

A List of the Genera of Birds, with their Synonyma, and an Indication of the typical Species of each Genus. By George Robert Gray. Second Edition. 8vo. London, 1841.

Mr. Gray's 'Genera of Birds' is a systematic catalogue of all the generic groups which have been proposed by ornithologists, with their synonyms, and a reference under each genus to some one well-ascertained species by way of type. Having on a former occasion (see Annals of Nat. Hist., vol. vi. p. 410, vol. vii. p. 26) published a commentary on this work when it first appeared, I am induced to offer a few further remarks on this new and improved edition. If the former work was deserving of high praise as a first attempt to introduce order and system into a chaotic mass of scattered observations, this edition may be still further commended on the ground of the great additional accuracy and completeness which it exhibits. In these days of hasty and superficial book-making, it is rare to meet with a work in which so much labour and research is condensed into so small a space, and as a tabular index of the present state of ornithology, it is one of the most complete works ever produced in any branch of zoology.

A work of such a nature is well adapted to supply statistical results. The actual number of genera enumerated in it amount to 1119. To these genera no less than 1961 Latin or systematic names have been given by different authors, so that 842 superfluous generic names have already been introduced into the science of ornithology. Yes! it is a humiliating fact, that into this most fascinating portion of Nature's Eden, no less than 842 *weeds* have been deliberately planted by the hands of those who professed to be the cultivators of